

Control of Leptospirosis in Man and Animals

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COMPLETE control of leptospirosis in man depends on the elimination of the infection in carriers. After acute or, frequently, inapparent infections in domestic and wild animals, the organisms become established in the kidneys and may be shed with urine chronically. Urinary shedders of leptospire are primary vectors: the infection passes to other animals and to man by direct or indirect contact with infected urine.

Preventive measures have most often been aimed at the leptospire outside the body of its host (1). In the past, control methods pursued the destruction of the leptospire by chemical agents, heat, or desiccation; or they were designed to prevent the leptospire from gaining access to the susceptible host by ratproofing, confinement, or protective clothing. At present, immunization of susceptible populations and elimination of carriers by antibiotic treatment are being emphasized. In some instances, however, the best means of control may lie in the prevention of contact. For example, in the United States, most outbreaks of leptospirosis in humans (primarily in children and young adults) have occurred as a result of swimming in stagnant pools or streams contaminated by infected urine from animals. Notices placed in schools and service establishments might prove effective in warning swimmers of their risk.

Vaccines

Leptospirosis among certain occupational groups such as abattoir workers, dairy farmers, animal husbandrymen, veterinarians, sewer workers, plumbers, and miners may be con-

trolled by vaccination. Early investigators reported the excellent immunogenic properties of *Leptospira icterohemorrhagiae* killed with phenol (2), heat and phenol (3), and heat alone. In Japan, thousands of persons have been inoculated successfully with these vaccines. Babudieri (4) has controlled leptospirosis caused by *L. icterohemorrhagiae* and *L. bataviae* in ricefield workers in Europe by vaccinating with a formalized vaccine. The choice of serotypes in the vaccines was determined by the epidemiological situation. In countries where the disease is a serious problem, immunization of the population at risk has not been widely practiced.

Although vaccines have not been used for humans in the United States, their use in domestic animals is becoming quite commonplace. As a means of controlling the disease by establishing immune animal populations, vaccination holds great promise. The vaccines that have been developed include the egg-propagated *L. pomona* bacterin of York and Baker (5), and the culture bacterin of Brown and associates (6). Hoag and Bell (7) have described a soluble antigen which protected calves, and a strain of *L. pomona* attenuated through more than 500 egg-passages has been evaluated as an immunizing agent by Kenzy and co-workers (8).

From 1 to 3 weeks are required for the development of immunity following vaccination, and

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the duration of this immunity has been reported for periods varying from 18 to 20 months (8). Young calves may be protected by vaccination of the dams during late pregnancy (9) and young pigs by vaccination of the sows (10).

Stoenner (11) has suggested prompt vaccination of an entire herd when the disease is diagnosed early. Since leptospirosis may spread rapidly, any delay in vaccination would minimize the protective effect of the vaccine. If abortions or other symptoms of the disease have occurred for 3 or more weeks, an immunizing agent is of little value in preventing further losses. Herds of this category should be tested, and only serologically negative animals, replacements, and calves born during the next 6 months would require immunization.

Improvements in the vaccines are needed before general control by vaccination can be achieved. None of the vaccines currently in use provides protection against all the leptospiral serotypes that have been isolated from animals in the United States. The vaccines available for cattle and swine provide protection against *L. pomona*, and those for dogs, against *L. canicola* and *L. icterohemorrhagiae*.

Herd Management and Sanitary Measures

Herd management and sanitation have considerable value in prevention and control. The factors in general herd management which afford protection against leptospirosis include isolation of sick and aborting animals, provision of sanitary quarters that can be easily cleaned, and provision of sanitary feeding and watering conditions, with special emphasis on watering tanks that prevent contamination. New animals should be held in quarantine for a period of 1 month or more before they are introduced into the main herd.

When the disease is diagnosed during the early phase of an epizootic, Stoenner (11) recommends prompt alteration of husbandry methods to effect an environment unfavorable for the spread of infection. Feed and water should be given in a manner which would prevent contamination with urine. Natural streams or surface waters are readily contaminated with urine of recovered carriers and should not be used

as sources of water. Farm ponds located in pastures should be drained or fenced and the cattle should be watered from tanks. The aprons surrounding these tanks should be free of seepage or overflow. Roughage should be fed from portable racks which can be moved frequently. Whenever possible, crowding of cattle in confined quarters should be avoided. On dairy farms, milk from cows should be pasteurized before being fed to baby calves. Horses, swine, and cattle should be kept in separate pastures.

Treatment of Carriers

Curing carriers by treatment has been tried by several workers. Ringen and co-workers (12,13) reported on attempts to eliminate the carrier condition in cattle infected with *L. pomona* by dihydrostreptomycin and terramycin therapy. Their findings suggested that dihydrostreptomycin given intramuscularly at a level of 5 mg. per pound of body weight every 12 hours for 3 days eliminated the carrier state. They demonstrated also that 2.5 mg. of tetracycline hydrochloride per pound of body weight was the minimal dose, since the 2.0 mg. level failed to prevent the development of carrier animals. The tetracycline hydrochloride was given intramuscularly once daily for 5 days. Baker and associates (14,15) found that in swine, disinfection of urinary shedders was accomplished as a result of 7-day feeding of terramycin at 500 gm. per ton of rations. He concluded that a program of high-level, short-term terramycin feeding to pregnant sows and gilts would significantly reduce losses from leptospirosis. Brunner and Meyer (16,17) found that streptomycin and aureomycin were possibly effective in clearing the urinary carrier state of hamsters and dogs infected with *L. icterohemorrhagiae* and *L. canicola*.

Wild Animals

Vaccination and the use of antibiotics may aid in the control of leptospirosis in domestic animals, but these methods cannot be applied to leptospiral shedders in wild animal populations. This problem may be approached by two methods; active campaigns to destroy carrier

animals by trapping or shooting, or the destruction of the leptospire in contaminated soil and water by disinfectant agents. The method used will depend on the circumstances.

In Japan, Tokyama (18) applied calcium cyanamide as a fertilizer to some of the rice-fields in an area where Weil's disease was very common. As a result of this treatment, the number of cases of Weil's disease was markedly reduced. In the United States, Molner and co-workers (19) studied a poultry-dressing establishment in which 18 cases of Weil's disease had occurred. The premises were heavily infested with rats, and the worktables were incompletely cleansed of blood and offal at night. *L. icterohemorrhagiae* was isolated by washing the tables with saline in the morning and injecting this fluid into guinea pigs. When the tables were swabbed with diluted hydrochloric acid in the evening, similar inoculations failed to infect guinea pigs.

Laboratory Animals

Laboratory animals may also serve as a large reservoir of leptospire. *L. ballum* has commonly been found among laboratory white mice (20), *L. icterohemorrhagiae* among laboratory rats (21), and natural infection with this serotype has occurred among guinea pigs (22). In Europe, *L. grippotyphosa* has been isolated from naturally infected hamsters (23). Stoenner (24) has recently reported infection of eight laboratory employees who had close contact with Swiss albino mice which were infected with *L. ballum*. Control of the disease in laboratory animals involves recognizing and destroying the infected animals, or possibly curing urinary shedders by the use of antibiotics.

Conclusion

It may be quite some time before effective control measures are developed for leptospirosis in the United States. At the present time we are just beginning to recognize leptospirosis as a disease of public health importance. Before we can control the disease, its extent must be determined in each locality. More cultural studies must be conducted to determine the sero-

types present. After the serotypes and the animals that are important reservoirs are known, effective control measures can be instituted.

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